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ABSTRACT

The Technology in Education program funded by the Sloan Foundation during 1970-1976 has supported 400 college faculty members to experiment with new technology in instruction. The major concern is to find out if the use of a great variety of technology can reduce instructional cost and improve learning. An overall observation indicates that the potential of educational technology in higher education is impeded by: (1) a lack of consensus as to the direction of technological advances; (2) adverse faculty attitude toward improving teaching by technology with inadequate reward; (3) the difficulty of cost reduction; (4) small-scale gains in learning; and (5) the low quality of software. To enhance the influence of educational technology, more research and large-scale experiment and development are necessary. (°C)

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ADVENTURES IN EDUCATIONAL TECHNOLOGY

by

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ADVENTURES IN EDUCATIONAL TECHNOLOGY

Summary of remarks by James D. Koerner, Program Officer, the Alfred P. Sloan Foundation, at the annual meeting of the American Association for the Advancement of Science, Boston, Massachusetts, February 21, 1970

My comments will deal mainly with the use of educational technology in colleges and universities. I won't try to say much, except by implication, about the relationship of technology to the broad question with which this day-long symposium is concerned.

Many of you probably assume that the array of audio-visual aids and electro-mechanical devices known collectively as educational technology will have an important, perhaps a central, role to play in the development of an applied science of education. I share that conviction, although I would rather call it a hope. Either way, my crystal ball suggests that a great many more years of work lie ahead before anything that could conceivably be called a technology of education -- or an applied science of education in which technology is an important element -- might emerge.

I base this opinion on the admittedly limited experience of one foundation program of very modest size. Yet I think the experience representative enough. In December 1970 the Sloan Foundation established a five-year program called Technology in Education whose purpose was to help

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college teachers experiment with new communications technologies in instruction. This program will be brought to an end on schedule in December 1976, by which time the Foundation will have made over seventy grants totaling $7 million. It will have supported about 400 faculty members in 100 institutions to explore the instructional uses of computers, television and related video systems, audio and slide-tape devices, teaching machines, and programmed texts.

The goal of the Technology in Education program has been twofold: to help educators find out if instructional costs can be reduced with technology, and to help them find out if learning can be improved. The first problem with which the Foundation was confronted, having decided to establish the program, was to define a modus operandi for it. The diffuseness and fragmentation that characterized work in educational technology suggested the need for special caution in the early stages of the program. A series of meetings was therefore held between the Foundation's staff and a number of outside experts over the first eighteen months of the program in an effort to give shape to an operational plan. The search was, of course, for a strategy that would allow the Technology in Education program to cut a clear path through the forest; that would allow the Foundation to impose some kind of order, at least as far as its own activities were concerned, on what

was not so much a "field" as a nationwide array of isolated unrelated, and often redundant, experimental project.

The question was considered, for example, of whether the Foundation, with its limited resources, should concentrate on a single field such as medical education where a certain momentum in the use of technology already existed; or whether concentration on a single technology, such as the computer, and its uses in many academic fields would be a better approach; or whether institutions and disciplines that had shown little interest in educational technology, such as liberal arts colleges or the humanities, should be encouraged to undertake work; or whether grants should be limited to projects in which a variety of technologies, not just one, were involved; or whether investments should be made mostly in projects using high-cost, high-capacity technologies like computers and television, or low-cost, flexible technologies like audio recorders or nothing more than a WATS line tying off-campus students to an instructional center.

Then the question was examined as to whether a small number of large grants or a large number of small grants was what was most needed; or whether it would be better to support individual scholars for small-scale work in their particular disciplines or teams of people for large-scale

work in several disciplines; or whether the best thing would be to support work in disciplines such as physics where substantial faculty interest already existed, or support work in such areas as library technology were the Foundation would have to stimulate much of the interest.

I record this litany of questions only to remind you that the exhortations often addressed to educational institutions, urging them to solve their problems by "using educational technology," are not automatically translatable into a sensible program. In the end, no specific plan emerged from our discussions, for no single approach commended itself with sufficient force to warrant the building of a program around it. The state of the art in educational technology was simply too rudimentary to justify the Foundation's favoring one technology, one discipline, or one type of research or institution over another. It was too rudimentary to justify anything but a broad and open approach.

That is, the Foundation made a deliberate decision that a master plan of the sort often associated with philanthropic programs was not feasible, or at any rate desirable. This decision meant that the program, lacking such a plan, would simply seek out and support the best people it could find, wherever it could find them, who had the best ideas and the greatest degree of interest in development work. It meant that the program would of necessity reflect

the diversity and to some extent the incoherence of work then going on in educational technology.

The grants that have been made over the last five years cover many disciplines, many technologies, and many methods of experimentation. A few have had the education of the faculty as their primary goal; all have educated the faculty as the work has gone forward. Some have been limited to a single technology; most have involved a number. Some have gone to liberal arts colleges; most have gone to universities. Some have sought to exploit the possibilities of simple, low-cost technology; others have been based on technologies with high initial costs but with the potential of economies of scale in the future.

Most of these projects cannot yet be individually evaluated. Collectively, however, they suggest a good deal about both the problems and the promise of educational technology, although there is more to be said about the former, I'm afraid, than the latter at the present time. The experience of the Foundation indicates that a family of singularly stubborn, interrelated problems will have to be overcome before the technologies of communications will make a major contribution to higher education or to an applied science of education. Let me mention some of these problems briefly as they have been encountered in the Technology in Education program.

1) The lack of consensus. As I have already indicated, there is a persistent lack of agreement amond leading experimenters in universities and in industry about how the state of the art in educational technology can best be advanced; no general consensus exists about where and how available moneys should be invested. That may be understandable in the present stage of development in educational technology, but it invests the process of grant-making with a higher degree of uncertainty and risk than is true of fields where experts are in at least approximate agreement about what needs to be done. However understandable, the pervasive lack of agreement among experts does little for the focus or clarity of a foundation's program or the tranquillity of those who manage it.

2) Adverse faculty attitudes. College teachers as a group continue to cast a cold eye on the application of technology to instruction. Whether because of genuine professional doubts, a concern for jobs, disaffection based on hearsay or perhaps on direct observation, or for other reasons, the American professoriate remains unmoved by the promise of technology in education and remains uninterested in experimental work. There may be a measure of justice in this apathy in view of the twenty-year record that educational technology has made. It is an attitude that may also

reflect what is valued in the academic profession: an interest in educational technology presupposes an interest in pedagogy, but pedagogy has traditionally taken second place to research in American universities and has been rewarded poorly in pay, promotion, and prestige. Even so, faculty attitudes are improving, albeit slowly, and one must settle for gradualism.

3) The difficulties of cost reduction. Often cited as the main objective of development work, cost reduction through the use of educational technology has always proved elusive. The majority of development projects have produced no persuasive evidence for the possibilities of cost reduction. It is true that development work on new technologies of any kind, far from reducing costs, always adds to them, which is to be expected in the early stages. But in the case of educational technology, it is not easy to foresee, except through the glass darkly, what cost reductions might become possible at the end of the development period when the experimental costs have been met.

Claims for the possibilities of cost reduction abound among researchers themselves, but are usually made on futuristic assumptions that invite argument. Thus there is, in the present state of the art, a certain artificiality in the frequent insistence by foundations and government agencies that the reduction of educational costs be a

primary target of the projects they support. Such a policy may waste money as well as retard and distort development work. Cost reduction will probably come in time but only after educators have done a good deal more work to discover whether and how they can use technology at any price.

4) Small-scale gains. The vast majority of experiments in educational technology produce, contrary to the claims of ebullient observers, very small gains, or none, in the learning that takes place. The customary finding in such experiments -- when there are respectable controls built into the experiments, which is infrequent -- is that students learn about as well from conventional instruction as they do from any given machine or panoply or machines. Even where gains are indisputable there is probably some "Hawthorne effect" as well as some "halo effect."

The question frequently asked by faculty members not involved in development projects in educational technology is whether the small gains in student achievement, where they exist, are worth the money spent, the controversy and disruption sometimes created, and the amount of faculty time consumed. Each department or institution must answer such questions for itself, but many will recognize that

small-scale gains are all that can be expected at the present time and that these gains will almost certainly be improved upon as work in educational technology is expanded in the future and refined on the basis of experience.

5) The low quality of software. Most of the materials now in use in educational technology represent nothing more than first-try efforts at creating software and have all of the imperfections that first-try efforts in education normally have. Not widely appreciated is the fact that the transformation of instructional materials from the conventional format of book and blackboard to one in which the substance is conveyed to unseen students by various communications machines is an exceedingly demanding, frustrating, and time-consuming task. Even determining what kind of topics lend themselves to presentation by what kind of devices is a problem requiring a good deal of experimentation, and when solved may be successful with only certain kinds of students. Once developed a software program needs an extended series of trials and tests, with subsequent revisions and retests, but this kind of painstaking, meticulous development work is rare. People run out of time, money, patience, and interest; and frequently their own scholarly research

calls them back from work on what are essentially pedagogical questions. The low quality of software remains the most important single problem in educational technology.

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The foregoing discussion of problems and obstacles in educational technology suggests that progress will continue to be made slowly. My view of the future, however, is not at all pessimistic. The only question is the kind of time-scale one wants to bet on. Although I think the future of educational technology is bright, saying so is like saying the future of fusion technology is bright: one feels certain that it is but has only a hazy notion of how long it will take for the technology to arrive in a widely usable form.

What can be said with confidence is that educational technology right now is still an infant, having toddled the first mile perhaps down a long road of research and development, which it must traverse for some time to come guided only by hunches, half-formed theories, some empirical evidence here and there, but without an adequate knowledge of the principles of human learning or of how these principles affect the use of technology in instruction. Many more starts and many more years of experimental work lie

ahead before we might see a general and widespread penetration of technology into the instructional programs of colleges and universities, and consequently before technology can play an important role in the development of an applied science of education.

My guess is that we need another twenty or twenty-five years before anything that could decently be called a unified theory of knowledge or pedagogy might evolve. To this end, large-scale experimentation with the machines themselves ought to have the beneficial effect of extending our understanding of human cognition, which in turn ought to tell us how to produce better materials and use machines to better advantage than in the past. I believe that American education by the turn of the century will look fundamentally different from the way it looks today, and that the difference will be attributable mostly to the technologies of communications.